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Assessing Self-Responsibility in Employability Competencies Development among Australian Engineering Students: Introductory report

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***Abstract*— Self-responsibility study initially outlined the importance of 'self-directed Adult learning' either as the method or the outcome of education. Attention was given to the different interest of individual's in accepting responsibility for their professional development. In this regard, several sources reveal the need for learners to take their own responsibility for developing employability competencies development. However, the concern must be expressed at the incompleteness of research into the personal responsibility for competency development.**

This paper reviews the conceptual frameworks related to an ongoing study at University of South Australia that examines the impacts of student's self-responsibility to the development process of employability competencies in Australian school of engineering. The definition of 'competencies' in this paper is consistent with the competencies specified by the Engineering Australia and the Accreditation Board for Engineering and Technology.

Keywords—self-responsibility; self-directed learning; Adult learning; employability; employability competencies

I. Background and Motivation

This introductory report presents an initial review of the literature used in an ongoing research study. The aim of the project is to examine the impacts of students' self-responsibility in the process of development of employability competencies in Australian engineering schools from the perspectives of students, alumni, university lecturers and industry. Thus, the objectives of this research are to (1) examine stakeholder understanding of the concept of students' self-responsibility for developing employability competencies; (2) examine self-responsibility as an appropriate practice for students to develop their own reflection to address their competency related deficiencies and their own approach to improve in this area; (3) study the factors that may become the perceived barriers for self-responsibility enhancing practice; and (4) investigate if self-responsibility practice has improved the quality of Australian engineering graduates.

In this regard, several studies have been conducted within and outside Australia to examine the employability competencies that are applicable for entry-level for engineering graduates [1-4]. Their findings were consistent with the competencies specified by the Engineering Australia (EA) and the Accreditation Board for Engineering and Technology (ABET).

Despite of those studies about competency development, without any commitment by or support from students, the competency development process cannot create graduates with the qualities that could meet employers' expectations. Thus, several questions have arisen in regard to the objectives of this research. We ask what the notion of 'self-responsibility' means for the stakeholders, listed above, and how engineering education can develop and enhance the practice.

II. Key Definitions

A. Self-responsibility

Self-responsibility is a technical term in our analysis which is used in a manner consistent with its common meaning. By 'self-responsibility' we mean the idea that students take responsibility for identifying, planning and addressing any employability skill limitations which they may have. This contrasts with the expectation that someone else will perform these functions, thereby taking a passive view that others will benevolently do what is good for them and that they are dependent on circumstances surrounding them. The notion of self-responsibility is consistent with the expectations of professional positions, in which the person is expected to take responsibility and exercise initiative in relation to work tasks.

B. Employability Competencies

Employability competencies are the set of knowledge, skills, abilities and attitudes necessary for the successful completion of the professional tasks which employers want done by the engineers whom they employ. These span a wide range, including

knowledge of the technical matters in field of practice and the personal; qualities necessary for successful practice. Demonstration of employability competencies is necessary in order to obtain work [5].

III. METHOD

This paper presents a review of the literature relevant to the concept of self-responsibility for the development of employability competencies with particular interest in issues relevant for engineering students in Australian universities. Engineering degrees at the Bachelor level in Australian universities are all accredited by Engineers Australia, thus enabling all graduates to be recognised as professional qualified as engineers. However, the accreditation process reviews the curriculum of programs presented for accreditation in the context of the institution offering the program to determine whether, at graduation, any person who graduates from the program should achieve a sufficient level on each of the criteria to satisfy the set competencies expected of graduate engineers, as described by EA [3, 6]. The Stage 1 criteria are similar to, but expressed differently than, the ABET a-k criteria.

The criteria include statements about competencies related to ability to identify and pursue professional development learning relevant to the individual, however, whilst the results of such an ability are evident in the career progress of professional people the ability to take the appropriate professional development actions is very difficult to assess and the affective elements related to the motivation to develop professionally are even more difficult to assess. However, the employability competencies, as a complete set, are the subject matter of what must be developed through taking appropriate professional development actions, which for each person, because of background abilities, will be different, and the motivation for which is only observable in-so-far-as the individual actually acts in a manner which enhances the manifestation of the competencies. Therefore the self-responsibility manifestation within each individual is virtually impossible to observe.

IV. RESULTS OF THE LITERATURE REVIEW

A. Student Self-Responsibility

The study of self-responsibility originated from the idea of 'self-directed adult learning' in which the learners take the primary responsibility either in the method or the outcome or the content of education. Lead by Knowles [7], several studies emphasized the contribution of 'self-responsibility' in the conception of andragogical principles. It is commonly accepted that andragogical principles empower learners to accept the responsibility for their learning [8].

The concept of self-direction in those studies led to the examination of factors that tend to promote self-responsibility in adult learning environments. Most studies heavily put attention to student's independence, for example: 'Andragogy leans heavily towards learner freedom …, promoting self-direction and personal autonomy' [9]. Student independence in determining their learning needs, identifying resources, choosing the activities and evaluating the outcomes [10-14] appears to be a major determinant for their future career [15-17]. The notion of 'independent', however, 'defined differently by different people' [8]. If, as emphasized by behaviorist theory, a person independence is determined by environmental influences, how could self-responsibility be developed or exercised when confronted with a constraining learning environment? According to Guglielmino, 'problem may arise, such as lack of resources or lack of time' [18]. Attention was given, therefore, to the different interests of an individual related to accepting responsibility for their learning process and progress.

One consequence of the learner's independence is capability to take primary responsibility in making critical judgments about a range of tasks and functions [19]. Brookfield [20] referred this as the 'field independent learner' who is influenced by 'both the external characteristics of an instructional process and the internal characteristics of the learner' [13]. Therefore, the notion of responsibility encompass both the capability of a learner to set their own pace and to put a personal structure on their learning [19]. As learner's responsibility increases, they show a higher degree of control over the planning and management of their learning; they can effectively locate and use a variety of resources; they are able to organize and make the best possible use of time; they see themselves as competent and effective and are confident in their ability to direct their own learning [8, 11, 19, 21-23].

B. Employability Competencies Development

Employability as defined above as the capabilities required to get and perform work [5] relates to the personal qualities [24] of an individual to be successful in the job market. Attention is given to the extent to which people possess the skills and other attributes to find and stay in work of the kind they want [25]. Thus, the term of 'employability' has been used by scholars and policy makers to describe the performance of an individual in their role [26, 27] or the adequacy of the preparation for school leavers [24, 28] and the unemployed to enter the labor market [29, 30].

In connection with these points, the development of employability competencies in the education sector, include Higher Education Institutions (HEIs) and the Vocational Education Training (VET) system, primarily has focused on the attributes required by graduates to meet the challenges of the labor market [2-4]. Because of changes in the economic situation, and

consequently the labour market resulting from globalisation and international competition in most classes of goods and services the nature of the required employability competencies has changed. The employability attributes consist of a combination of technical and soft competencies applicable in the current global working environment. These effectively become the bridge for the gap that exists at the level of competencies demanded by industry and those developed in a traditional engineering education curriculum [30]. Therefore, governments in their concern for employability competencies development, have focused on students' personal competencies. The UK government for instance, outlines two sets of appropriate competencies that could be used in preparation for job seekers to enter the labor market. The first set is 'basic skills' which encompass the competencies in the areas of communication, numeracy and information technology. The second set is known as 'wider key skills'. Wider key skills primarily focus on the personal abilities such as ability to work in a team, problem solving and personal skills [31].

The emphasis on competency development has affected student's perception of the particular elements required to meet the needs of individual and employers [3]. For example, the construction of the framework used in Australia has outlined the competencies that are mandatory for Australian workers in various global working environments. The first study on the competencies development provided a set of generic competencies to increase the employment opportunities for Australian graduates in the international labor market [32]. A second study developed seven important competencies for graduates to enter the labor market in any occupations [33], known as the Mayer competencies. The third study shows that the Mayer competencies have been applied in several areas [34] and have become a widely used framework in industry and the education system. Eight areas of competency are covered by the framework:

1. **Communication** that contributes to productive and harmonious relations between employees and customers,
2. **Teamwork** that contributes to productive working relationships and outcomes,
3. **Problem-solving** that contributes to productive outcomes,
4. **Initiative and enterprise** that contribute to innovative outcomes,
5. **Planning and organizing** that contribute to long-term and short-term strategic planning,
6. **Self-management** that contributes to employee satisfaction and growth,
7. **Life-long learning** that contributes to ongoing, and
8. **Technology** that contributes to effective execution of tasks.

Although government action related to the competency of graduates may have impacted labor market outcomes, the policies have not automatically increased employment [35]. Government policies do not automatically eliminate the internal characteristics of individual that could be barriers to gaining a job (e.g. attitudes, motivation, abilities and beliefs). Government interventions often fail to create the conditions that might motivate graduates or workers to develop the appropriate competencies that help them in gaining employment. Thus, although employability competency development has embedded into the education curriculum, it is necessary to have deeper explorations of both the conceptual understanding and the impacts of student self-responsibility in the development with particular focus on engineering education.

C. Student self-responsibility in Competencies development

The focus of the engineering education and training system has been on creating methods or techniques for preparing students to gain the appropriate competencies which could be applied in work [36]. In recent studies, engineering educators have recognized the need to equip their students with broad employability competencies. Initially, most consideration was given to the employability competencies development. The competencies development focus suggests belief that the key for survival in the labor market is mainly determined by the characteristics [26] of an engineering student in taking responsibility to comply with the industry's demands through the participation in employability-enhancing activities, such as in-house training or job seeking activities. Without any responsibility or commitment from the learners in the competencies development activity, the competencies development process only creates reconstruction of competencies and duplication of schematic thinking [37]. In turn, this creates low quality graduates who lack competencies, poorly trained and unproductive and become barriers for graduates to be adaptable to various workplace situations and conditions [38].

Callan has reported an empirical investigation of the relationship between student motivation and the development of employability competencies in the classroom [39]. Callan conducted a survey and interview to find the perspectives from students and teachers at nine Technical and Further Education (TAFE) Institutes in Australia toward generic skills development. Callan collected data using a questionnaire to examine the level of understanding of students and VET teachers about the importance of learning generic skills. Then, semi-structured interviews of 25 (twenty five) senior managers and teachers in Queensland, New South Wales, Victoria and South Australia were conducted. Through this approach, Callan focused on students' self-commitment responsibility particularly in the integration of generic skills into the teaching practice.

The findings showed that students and teachers gave positive responses to the benefits of the concept. However, the findings also showed that without any commitment supports from students, that the integration process did not create graduates with the qualities that could meet the employers' expectations. According to Callan, '…fostering generic skills requires changes to the motivations of students. Learners need to take responsibility for their own learning' [39]. Thus, student's self-responsibility should be seen as one of the key components of effective employability competencies development.

Following this point of view, an engineering student has sole responsibility to develop a set of competencies that are needed to cope well throughout his/her career. Student self-responsibility demands the willingness to take over the responsibility for the development of competencies. In this literature review, thus, we have focused on the stakeholder's mutual understanding about self-responsibility (i.e. what employers believe about student self-responsibility related to the efforts to improve the quality of engineering graduates) for three reasons. First, self-responsibility in competency development will help students to develop the ability to reflect on their current position in the labor market. Through the reflection, students could address their weakness in the particular area of competencies and develop their own approaches to improve their weaknesses. The construction of self-awareness through the reflection will affect student's perspectives and paradigms [20, 40] of independency in determining their needs in particular competency area. Several work-experience activities, such as part-time work, voluntary activities, community involvement, extra-curricular activities and participation in student associations; therefore, can be used by students as approaches to improve their deficiencies in the particular area of competencies (Table I).

TABLE I. A COMPARISON OF SELF-RESPONSIBILITY IN COMPETENCY DEVELOPMENT [ADAPTED FROM 41]

Carmean	Dabbagh	Weigel
Active learning involves solving real-world problems; using judgment and exploration; situated in action; emphasis on practice and reinforcement; involvement in real-world	**Authentic learning** focuses on real world and complex problems that are interdisciplinary, occur over long periods of time and involve a range of learning materials and resources	
Learning that is **social** provides opportunities for cognitive apprenticeship; reciprocity and cooperation among students; prompt feedback; encouragement of contact between student and faculty; emphasis on rich, timely feedback.	**Dialogue** facilitate articulation, collaboration, reflection **Guidance** in learning is built on modelling, scaffolding, coaching	**Communities of inquiry** support habits of mind, interactions, and negotiation of knowledge.
Contextualized learning builds on existing knowledge and is integrated into the learner's world; knowledge is demonstrated; deep foundation of factual knowledge; consideration of leaner preconceptions; focus on how the world works; facts and ideas in the context of a conceptual framework; concrete rather than abstract.		**Conditionalized knowledge** "specifies the contexts in which it is useful" (p. 6).
Engaged learning addresses diverse talents and ways of learning; high expectations; high-challenge, low-threat environments; intrinsic motivators and natural curiosities.	**Exploration** involves problem solving, hypothesizing, inquiring, role-paying	
Learning encourages **ownership** so that learners can organize knowledge in ways that facilitate retrieval and application; learner control of own learning; time on task; learner independence and choice; time for reflection; higher order thinking	**Self-directed learning** promotes self-awareness and regulation	**Metacognition** involves thinking about thinking as a strategy to analyse understanding and adjusting learning strategies then learning is not achieved.

Second, the independence in self-responsibility will provide the individual the opportunity to be an 'independent learner'. Expressed in this way, employability competencies are developed from the integration of three sets of inter-related factors: knowledge, skills and attitude. The cognitive factor provides a foundation for thinking capability which could be used for

manipulating knowledge for different purposes [42]. Meanwhile, the skill acquisition is constructed from the transitions of knowledge in differing stages [43] and is contributed to by individual's affective motivation and behavior [42]. Since self-responsibility is a cognitive process grounded in reflection, linked to an affective valuation of reflection and tailored development actions for the purpose of improving one's own prospects, 'whereby we learn how to change our perspectives, shift our paradigms, and replace one way of interpreting the world by another' [20]; then the process encompass the needs of Field Independent (FI) learners. A student with a FI style, therefore, tends to create his or her own structure [23] in the process of gaining the appropriate competencies.

Third, self-responsibility encompasses the different interest of an individual in accepting the responsibility. The argumentation found in the literature postulate that self-responsibility is affected by the capacity of the 'agent' to act freely. The notion of agent refers to the sense that an individual has ownership of action [44] within competencies development and becomes the trigger to the possession of necessary competencies. This ownership is expressed through activities that could trigger the response for their own weakness along with accepting the consequences of intentional change [45].

V. CONCLUSION

This study has provided evidence of the need for enhancing student self-responsibility practice within the employability competencies development field of educational practice. This study has introduced an approach that may be relevant to improve the quality of engineering graduates.

The review of literatures showed that when students accept the primary responsibility in the process of competency development, they could develop the ability to reflect on their current position in the labor market market in a way in which they view themselves as active agents with the power to take self-development action choices that can result in material change to their situation. The evidence from the literature also shows that the ability to purposefully reflect has positive impacts on the willingness of an individual to take responsibility, which could help students in creating their own approaches to possess the appropriate competencies to enhance their career prospect.

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